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LUMINARY Memo # 89

TO: Distribution
FROM (in alphabetical order): P. Adler, D. Densmore
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SUBJECT: A Metaphysic of Downrupts

Chapter 1: On the Nature of Downrupt "Loss"

It has been suggested that the addition of C13STALL (a routine to fix a serious hardware problem) has increased the probability of "losing downrupts" .

The simulator indicates that a downrupt has been "lost" when a second downrupt occurs before the previous downrupt has been honored. This, however, is not the only condition that will cause loss of downlink information.

A "lost" downrupt does not mean that any interrupts are never processed; but that due to the interrupt having been delayed, downlink information will be lost.

The interrupt in this case is delayed past the time that the information is automatically read out of the channels and transmitted to the ground. This results in old information, i.e. that put into the channels by the previous downrupt, being sent again.

When this delayed downrupt is finally honored, it puts the next information to be transmitted in the down telemetry channels; but the next downrupt (which is waiting in the case recognized by the simulator) comes in and writes over it.

This newest information is sent at the next automatic transmission to the ground. The information put into the channels by the middle downrupt is then lost, even though the rupt itself was processed.

The case recognized by the simulator is only an extreme case. Downlink information can be lost even if the delayed downrupt is honored before the next one is due.

This happens if the first downrupt hasn't finished its processing before the information is automatically transmitted to the ground (half a millisecond before the next downrupt even tries to get in).

Chapter 2: Of Word Order Codes

In addition to the two words of erasable put into Channels 34 and 35, every downrupt also provides a "word order code", bit 7 of Channel 13, to assist the ground in synchronizing the lists.

The word order code is read by the telemetry hardware at the same time it reads Channels 34 and 35. However, it is now possible that up to 3 milliseconds could elapse between the time the word order code is put into Channel 13 and the time that erasable information is put into Channels 34 and 35.

The longest delay is in the downrupts that store snapshot information for future downrupts. (This currently occurs in the 2nd and 52nd word of every list.) It is possible, in fact, for the automatic downlink transmission to occur after the word order code is written but before Channels 34 and 35 are written.

The word order code is "1" for every word of the list except for the 1st (ID) and 51st (TIME1, TIME2). For these words the word order code is cleared, thus making it necessary to write a "1" back in on the 2nd and 52nd words of the list.

Chapter 3: Of Radar Stalls

Due to a hardware problem it was found dangerous to write into Channel 13 while radar information was being transmitted to the AGC. Consequently, a routine was written which could be called before every Channel 13 write. This routine checks to see if a radar read is in progress and if so loops until it is safe to write in Channel 13. The delay here could be up to 5 milliseconds.

Chapter 4: Watch Out for Number Two.

Words potentially delayed by the radar stall, then, are the 1st, 2nd, 51st, and 52nd. As we saw above (Chapter 2), the 2nd and 52nd words are already particularly long downrupts. Thus the probability of losing downlink information in any of the above described fashions (see Chapter 1) is increased.

Chapter 5: Ameliorations -- I (Change the Downlink Program)

Proposal:

Our first suggestion is to eliminate as much as possible of the delay between the setting of the word order code and the writing into Channels 34 and 35.

This would not change the length of the interrupt processing, and thus it won't prevent downlink information from being lost by conditions such as those discussed in Chapter 1. However, it will minimize the possibility of the wrong word order code being sent (new word order code with old erasable information), as discussed in Chapter 2.

Advantages:

The coding to do this is simple and does not increase the time in interrupt.

If the second word is lost through delays, the first word, i.e. the ID, will be sent again. As it stands now, the word order code might well have been changed back to "1" in preparation for sending the second word. This makes it more difficult to detect the fact that information was lost, because the ground can only check for lost information by counting the number of word-order-1 words between the word-order-0 words.

The advantage of the new coding is in this case. It will allow the ground to more easily detect the error by causing 2 consecutive word-order-0 words to appear.

Disadvantages:

This method does nothing to eliminate the problem, it only makes it easier to recognize.

Chapter 6: Ameliorations -- II (Change the Downlists)

Proposal:

A perhaps more satisfactory solution would be to avoid the loss of downlink information altogether. To this end may we suggest that the downlists simply be rearranged so that the sanpshot information is not being stored in a downrupt which may contain a Channel 13 stall for radar activity.

That is, snapshots should be physically moved on the actual downlists so that they do not occur on the 2nd and 52nd words of the list.

Advantages:

This reduces the maximum downrupt from 8 milliseconds (5 for radar stall plus 3 for storing snapshot data) to 6 milliseconds (5 for radar stall plus 1 for normal downrupt), thus reducing the probability of lost information.

This requires no change in AGC coding, as the downlink program is indifferent to the order of words on the lists.

Disadvantages:

Like any change to the downlists, this would require a change in the allegedly sacrosanct RTCC programs. Moreover, it does not eliminate the possibility of lost information, only reduces it, and does not protect against sending an updated word order code with the old information.

Chapter 7: Teleology

The discerning reader, having diligently studied the first principles laid out, pondered the relationships of matter and form in downlink processing and actuality and potentiality in the transmission of the information; and having carefully considered the conclusions to which our analysis of these problems of being and becoming brings us, no doubt realizes that it is possible to implement both suggested ameliorations.

Such is our recommendation.